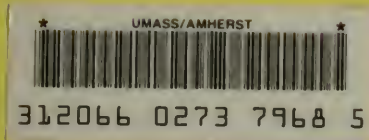


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1988 AND 1989
MARTONE LANDFILL
AND
POWDER MILL POND
EVALUATION

GOVERNMENT DOCUMENTS
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1988 AND 1989 MARTONE LANDFILL AND
POWDER MILL POND EVALUATION

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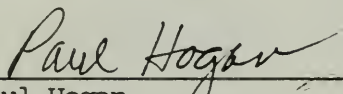
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AUTHOR: Richard S. Dorfman

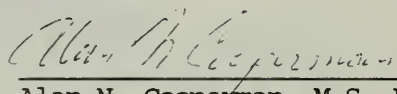
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EXECUTIVE SUMMARY

This report determined the potential impact of the Martone Landfill on the water, sediment, and fish of Powder Mill Pond. The landfill, which is adjacent to Powder Mill Pond, has been used as a municipal and commercial landfill since 1971. There was concern over potential health impacts of leachate since Powder Mill Pond is a popular swimming and fishing area and the aqueduct which diverts water to and from Quabbin Reservoir underlies, or is adjacent to the pond.

Powder Mill Pond water quality and monitoring well groundwater sampling data conducted seasonally by a laboratory at the site were reviewed. Occasional elevated levels of iron, manganese, lead, chromium, copper, and zinc were observed in the water column. Elevated levels of iron and manganese in the monitoring wells indicated potential impacts from the active landfill site and the inactive site which was abandoned in 1976.

Field data was collected beginning with water and sediment sampling in Powder Mill Pond in October 1988. Sampling of the monitoring wells on the Martone Site were conducted in December 1988. Fish sampling was conducted in June 1989.

Results and Discussion

Powder Mill Pond was classified as mesotrophic based on nutrient levels, dissolved oxygen concentration, and the extent of plant growth for the season. The field pH were very low ranging from 4.0 to 5.2 standard units. Some rainfall had occurred the evening previous to sampling.

Levels of copper exceeded 1986 EPA water quality criteria for acute toxicity throughout the pond while iron concentration exceeded EPA criteria across from the landfill. However, sediment metals concentrations were all lower than the state criteria for Category I Dredge and Fill Materials (316 CMR-9.00). Therefore metals were not impacting the sediment on the date sampled.

Groundwater monitoring of the monitoring wells showed potential impact from both the active and the closed landfill sites from iron, manganese, five-day BOD, COD, and phosphorus. PCB's were observed in the Martone water supply well and on one well opposite from the closed landfill site.

The metals concentration in edible fish fillets showed that only the concentrations of mercury and manganese exceeded the state-wide average. The maximum mercury levels of 0.86 mg/kg and 0.88 mg/kg out of 12 samples analyzed approached the FDA action limit of 1.0 mg/kg. Concentrations of PCB's and percent lipids were very low. The maximum PCB tissue burden of 0.56 mg/kg was below the FDA action limit of 2.0 mg/kg. The bioaccumulation of toxic metals and PCB's in fish from Powder Mill Pond does not demonstrate major problems.

Although leachate from the Martone Landfill did not impact Powder Mill Pond on the day sampled, continued monitoring of the pond and groundwater must be conducted to determine if contaminated leachate is still migrating from the two landfill sites, or is impacting the pond.

ACKNOWLEDGEMENTS

Gary Bogue of the Technical Services Branch assisted in the collection of pond and sediment samples. Gary Rogowski, Mark Allen, and Andrew Durham of Standard Methods, Inc. provided the equipment and effort to collect groundwater samples. Gerry McCall of the Technical Services Branch assisted in collecting the groundwater samples. Larry Polese of the DEP-DWPC Technical Assistance and Training Section collected samples from the leachate treatment system. John Lindenberg of the Division of Fisheries and Wildlife provided technical assistance in collecting fish.

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INTRODUCTION

Background

The Martone Landfill and Powder Mill Pond Study was conducted in response to concerns expressed by the Massachusetts Division of Fisheries, Wildlife, and Environmental Law Enforcement (MDFW & ELE) and the Barre Board of Health. The location of the landfill and the pond is shown in Figure 1. The objective of this study was to determine whether the leachate from the landfill is impacting Powder Mill Pond and the groundwater. To attain this objective, evaluations were conducted on:

- 1) the quality of the water and sediment in Powder Mill Pond which is adjacent to the Martone (town of Barre) Sanitary Landfill
- 2) the quality of the groundwater on the Martone site
- 3) the effectiveness of the leachate treatment lagoons, and
- 4) bioaccumulation of toxic metals and organics in edible fish fillets.

There is concern over the potential health impact of landfill leachate on Powder Mill Pond because:

- 1) Powder Mill Pond is a popular swimming and fishing area, and
- 2) an aqueduct which diverts water to and from the Quabbin Reservoir underlies or is adjacent to areas of this impounded section of the river. The intake shaft (MDC shaft No. 8) is approximately one and one half miles upstream of the pond. Upstream of the MDC intake, the Ware River is used as a water supply.

In late fall 1987, staff of the MDFW & ELE collected samples of top feeding predatory fish from Powder Mill Pond for analysis of mercury as part of the Metropolitan District Commission Mercury Action Plan for Quabbin Reservoir. During the survey, the MDFW & ELE noted that the pond was potentially eutrophic due to the landfill and its leachate contamination. Many seagulls were observed feeding at the landfill, and then proceeding to rest on the pond. In July 1988, staff of the Massachusetts Division of Water Pollution Control (MDWPC) conducted a site visit. The water of Powder Mill Pond was highly colored. Pickerelweed (*Pontederia cordata*) and water lilies (*Nymphaea* sp.) were observed in coves.

Site Description

The Martone Landfill has been used as a municipal and commercial landfill since 1971. The approximate layout of the landfill is shown in Figure 2. Site 1, which was abandoned in 1976 and closed in 1981, has a clay cap with gravel cover. Two trenches were dug into the clay substrate - one to prevent leachate from traveling to Powder Mill Pond and the other on the uphill side to divert clean water away from the site into "Barre Brook".

FIGURE 1 MARTONE LANDFILL AND
POWDER MILL POND
SITE MAP

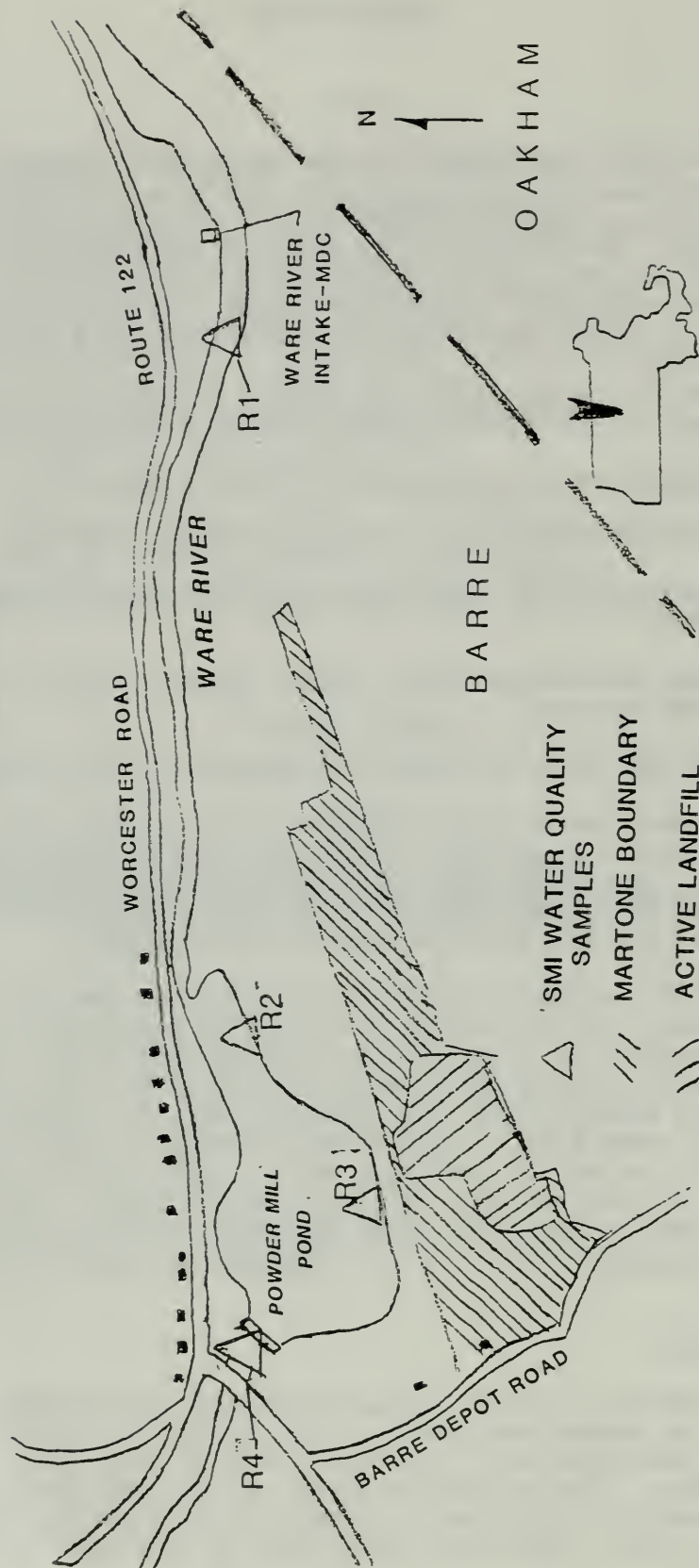
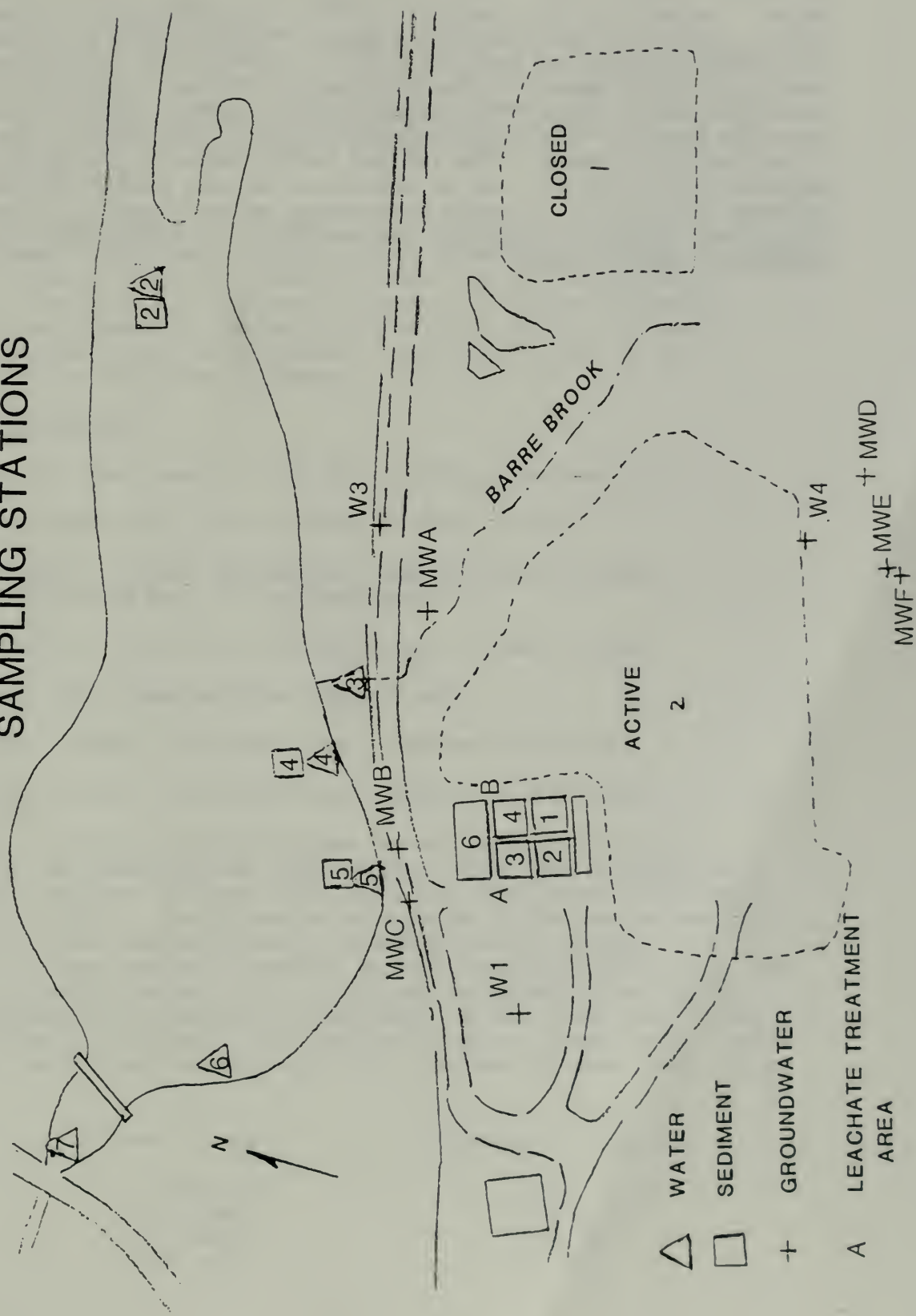


FIGURE 2 MARTONE LANDFILL AND
POWDER MILL POND
SAMPLING STATIONS



A site inspection conducted by MDWPC staff reported a few small areas where an oily substance was leaching from the slope of the landfill.

The active landfill area, Site 2, is capped with clay on both the top and sides. Leachate from the landfill cells is collected through a leachate piping system and discharged into a series of polyethylene lined lagoons. Biological treatment and settling occurs in the lagoons. The primary receiving lagoons contain diffused air devices. These lagoons contain high concentrations of algae. The primary treated leachate is discharged to secondary lagoons. Results of sampling indicate improvement in the quality of the secondary lagoons. The effluent is discharged to the ground. A groundwater infiltration area is located on the west side of the lagoons adjacent to Lagoon 6. In order to discharge effluent equally in both directions, it has been directed eastward toward an infiltration area adjacent to "Barre Brook".

HISTORICAL DATA ANALYSIS

In 1981 staff from the MDWPC conducted a survey and sampling at the Martone Landfill. Results indicated organic compounds in samples collected from the closed landfill. None were found to be migrating off the site. Concentrations of metals on samples were all below drinking water standards. A soil sample collected from a marshy inlet in Powder Mill Pond upstream of Barre Brook exhibited elevated levels of iron and manganese which were not considered a problem. The sample was collected at a leachate brooklet.

In 1984, Standard Methods, Inc. (SMI), a laboratory hired by Martone Trucking, began monitoring of surface water, groundwater, and the leachate treatment system at the active landfill site. The SMI surface water monitoring sites on the Ware River and Powder Mill Pond are shown in Figure 1. The location of the monitoring wells is shown in Figure 2. Results of surface water and groundwater data collected by SMI are summarized in the following discussion.

Surface Water Quality

Samples are collected seasonally at the following locations by SMI:

- R1 Ware River, foot bridge by the MDC water intake
- R2 Powder Mill Pond, upstream of landfill, close to shore
(across from Kozy Kitchen Restaurant)
- R3 Powder Mill Pond, across from lagoons, close to shore
- R4 Ware River, New Braintree Road bridge
- S1 "Barre Brook", off access road, upstream of landfill
- S2 "Barre Brook", off access road, downstream of landfill

Station R1 is located in the Ware River segment upstream of the MDC intake, which is classified for water supply. Since this location is one-half mile upstream of Powder Mill Pond, the river is not affected by the Martone Landfill. The pH was low with three of nine values less than 6.0 standard units (lowest pH was 4.9 standard units). Metals concentrations were evaluated based on criteria developed by the U. S. EPA for the protection of aquatic life. They are contained in the report entitled EPA Quality Criteria for Water 1986¹, or the "Gold Book". Many of these criteria are based on the instream hardness. Based on the range of hardness concentrations, the "Gold Book" one-hour concentrations are as follows:

	Hardness = 15 mg/l	Hardness = 25 mg/l
Cadmium	0.00046 mg/l	0.00082 mg/l
Copper	0.0030 mg/l	0.0048 mg/l
Lead	0.0073 mg/l	0.014 mg/l
Zinc	0.066 mg/l	0.10 mg/l

Concentrations greater than the "Gold Book" criteria indicate potential instream toxicity. Except for lead at a hardness of 25 mg/l and for zinc, the "Gold Book" criteria are below the detection limits used by the laboratory and therefore the effect on toxicity is unknown.

At Station R1 the zinc concentration exceeded the "Gold Book" criteria on two of six sampling days. The maximum concentration was 0.2 mg/l. Copper, cadmium, and lead were each detected on one sampling date. The cadmium and lead concentration and one elevated zinc concentration all occurred in October 1987.

Station R2 is located near the shore, upstream of the active landfill site, but across from a cleared area on Martone land, which will be used as a new landfill site. The zinc concentration at Station R2 exceeded its "Gold Book" criteria on the same two dates as at Station R1. The maximum concentration was 0.4 mg/l. Copper was detected on two occasions and cadmium was detected on three occasions. Lead, cadmium, copper, and zinc were all detected on April 1988.

Station R3 is located off the shore across from the leachate treatment lagoons and therefore potentially could be impacted by the landfill. Again the zinc concentration exceeded the "Gold Book" criteria on two sampling dates. As at Station R2, copper was detected on two occasions and cadmium was detected on three occasions. Copper, cadmium, lead, and zinc were all detected on April 1988.

At Station R3, the iron concentration was significantly higher than at Station R1 and R2 on two occasions (February and April 1988). The manganese concentration was also slightly higher on those dates. This indicates that the landfill may be impacting water quality on those dates.

Water quality at Station R4 should not be influenced by the landfill unless pollutants are transported over the dam. Although zinc was detected on four sampling dates, the maximum concentration was only 0.14 mg/l. Only copper was detected on one sampling date. The iron and manganese concentrations in February and April 1988 were at the same levels as Station R1.

Data generated by SMI shows that "Barre Brook" does not transport significant pollutants into Powder Mill Pond. However, cadmium and zinc were detected at both stations. Cadmium was detected on three of six sampling dates upstream (station S1) and four times downstream (station S2) of the landfill in 1987 and 1988. At this period, zinc was detected on two occasions upstream and on three occasions downstream of the landfill. In February 1988, the highest zinc concentration of 0.3 mg/l occurred downstream of the landfill.

Volatile organic sampling had been conducted in August 1987 and April 1988 at stations R1 and R4. In 1988, methyl ethyl ketone was detected at a concentration of 31 $\mu\text{g/l}$ and acetone was detected at a concentration of 42 $\mu\text{g/l}$ at station R1. Neither was present in 1987. The same organics were detected at 160 $\mu\text{g/l}$ and 110 $\mu\text{g/l}$, respectively, at monitoring wells MWB and MWC, across from the leachate treatment lagoons.

Groundwater

The groundwater monitoring wells sampled by SMI are identified on Figure 2. SMI's physical/chemical and metals data are available from six wells identified as MWB, MWC, W3, MWA, W1, and W4 (Appendix A). Iron and manganese concentrations were highest at monitoring wells MWB and MWC which are located across from the lagoons. This indicates that the groundwater is impacted by landfill leachate. A mean iron concentration of 78 mg/l was exhibited in samples from monitoring well MWB and a concentration of 38 mg/l at monitoring well MWC for six sampling dates. The mean manganese concentrations was 1.6 mg/l at monitoring well MWB and 3.2 mg/l at monitoring well MWC. The ammonia concentration was very high at MWB with an mean concentration of 42 mg/l, while the mean ammonia concentration at monitoring well MWC was 1.1 mg/l. Although there is not a drinking water standard for ammonia, ammonia introduced into the pond could cause oxygen depletion or toxicity. The concentration of total organic carbon (TOC) which is indicative of oxygen demand was highest at monitoring well MWB, with a mean of 29.5 mg/l. At monitoring well MWC, the maximum TOC was 58 mg/l, but the mean concentration on the other five dates was 3.6 mg/l. The chloride concentration was also highest at these wells indicating potential impact - 46 mg/l at monitoring well MWB and 41 mg/l at monitoring well MWC.

The mean iron and manganese levels at monitoring well W3 were 20 mg/l and 0.92 mg/l, respectively, indicate that leachate from the closed landfill is still impacting the groundwater. The manganese concentration had decreased from 1.5 mg/l on August 1985 to 0.7 mg/l in February 1988. Iron concentrations were variable and much lower at monitoring well MWA than at monitoring well W3 - ranging from less than 0.1 mg/l to 2.5 mg/l. The mean manganese concentration was 0.85 mg/l. TOC concentrations were also much lower than at monitoring well MWB. Mean TOC concentrations were 3.4 mg/l at monitoring well W3 and 2.6 mg/l at monitoring well MWA. Chloride concentrations were also lower - 8.2 mg/l at monitoring well W3 and 11 mg/l at monitoring well MWA.

Monitoring well W4 on the upgradient edge of the landfill exhibited the lowest concentrations of the parameters which had been significant in the downgradient wells. The iron concentration ranged from 0.7 mg/l to 2.0 mg/l with a mean concentration of 1.3 mg/l. The manganese concentration ranged from 0.17 mg/l to 0.48 mg/l with a mean concentration of 0.30 mg/l.

Monitoring well W1, the water supply well for the Martone site, has been impacted by a manganese concentration which had increased from 0.09 mg/l to 1.1 mg/l during 1987 and 1988. However, the iron concentration ranged from less than 0.10 mg/l to 0.15 mg/l. No significant metal concentrations were noted.

Zinc concentrations were occasionally elevated in all wells, ranging from 0.10 mg/l to 0.30 mg/l to a maximum concentration of 0.40 mg/l at monitoring wells MWC and W4. The arsenic concentration exceeded the drinking water standard at monitoring well MWB on only one sampling date.

Leachate Treatment System

Additional removal did not always occur in the secondary lagoons. The concentrations of ammonia-nitrogen and five-day BOD were very variable, ranging up to 900 mg/l for five-day BOD and 40 mg/l for ammonia-nitrogen. While iron or manganese were sometimes removed, both were not successfully removed at the same time.

SAMPLING PROCEDURES AND ANALYTICAL METHODS

Sampling locations and parameters were chosen to characterize a number of environmental components affecting Powder Mill Pond and to determine the effectiveness of the leachate treatment system: water quality of the pond, surface water inputs to the pond, surface water output from the pond, sediment quality of the pond, effectiveness of the leachate treatment system, groundwater quality, and bioaccumulation of toxics in edible fish fillets.

Surface Water and Sediment

On October 18, 1988, TSB personnel conducted a water quality survey of Powder Mill Pond. Seven water quality and three sediment stations were sampled (see Table 1). All pond samples were collected in pre-washed sample containers (see Appendix B). The analyses conducted on surface water and sediment samples are shown in Table 2. The methods of analysis used by the Lawrence Experiment Station are presented in Appendix C. Ware River samples were collected by bucket drops, while pond samples were collected by holding the bottles over the side of the boat. Before samples were collected, the bucket and bottles were rinsed with sample water. Water quality metals and nutrient samples were fixed in the field. Additional parameters: dissolved oxygen, temperature, pH, and specific conductivity were taken in the field using the Hydrolab[™] Model 4041 automatic analyzer.

Sediment samples were collected from the boat by dropping a petite ponar dredge - one for collecting metals, nutrients, and total volatile solids samples and one for collecting organic samples. Before sampling for organics and after collecting each sample, the dredge was cleaned first with acetone and then hexane. The metals, nutrient, and total volatile solid samples were collected in plastic jars, while the organic samples were collected in glass bottles furnished by the Lawrence Experiment Station. The analyses performed on sediment samples are presented in Table 2.

The location of the 1988 Ware River and Powder Mill Pond water quality and sediment stations are located on Figure 2. Water quality Station 1 (not shown) on the Ware River at the Route 122 bridge was located 1.2 miles upstream of Powder Mill Pond. This site represented the reference. Station 2 was located inside the pond approximately across from SMI Station R2. This site should not be impacted by the landfill. Station 3 was located in "Barre Brook", the surface water input which passes through the site, which could carry runoff from the landfill. Stations 4 and 5 were positioned in coves just off the shoreline. Station 4 was located 75 feet downstream from "Barre Brook" and Station 5 was 275 feet further downstream of this site across from the groundwater infiltration area located near SMI station R3. These stations would most likely receive potential impacts from the landfill. Station 6 was positioned offshore downstream from the landfill. Station 7 was downstream of the pond and dam at the New Braintree Road bridge (same as SMI station R4). Sediment stations were the same as Stations 2, 4, and 5. Stations 4 and 5 were moved away from the shore due to different sediment composition.

TABLE 1
MARTONE LANDFILL EVALUATION
SURFACE WATER AND SEDIMENT SAMPLING
SITE DESCRIPTIONS

STATION	LOCATION	DEPTH (ft)	SEDIMENT	
			DISTANCE FROM SHORELINE (ft)	COMPOSITION
1	Route 122 bridge, 1.2 miles upstream from Powder Mill Pond	--	--	--
2	Center of entrance to Powder Mill Pond (same as R2, but in center)	7	140	muck
3	"Barre Brook"	--	--	--
4	In cove 75 ft. down from "Barre Brook"	5	60	muck
5	In cove 300 ft. down from "Barre Brook" (near R3)	11	40	muck
6	Southwest corner of pond	13	--	--
7	New Braintree Road Bridge (near R4)	--	--	--

TABLE 2

SAMPLING ANALYSES

MEDIA	BACTERIA	PHYSICAL/CHEMICAL	NUTRIENTS	METALS	ORGANICS
Surface water	--	SS, TS, Alk, Turb Cond, pH, Color, Cl	TKN, NH ₃ -N, NO ₃ -N, Tot P	Al, Cd, Cr, Cr(VI), Cu, Fe Pb, Hg, Mn, Ag, Zn, Hard	VOA, A+N/B
Sediment	--	TVS	TKN, Tot P	Al, Cd, Cr, Cr(VI), Cu Pb, Hg, Ag, Zn, EP Tox	VOA, A+B/N, PCB
Groundwater	Fec, Tot	BOD, OOD, SS, TS, Alk, Cond, pH, Cl	TKN, NH ₃ -N, NO ₃ -N, Tot P	Al, As, Ba, Cd, Cr, Cr(VI) Cu, Fe, Pb, Hg, Mn, Ag, Zn Hard	VOA, A+B/N, PCB
Leachate Treatment System	Fec, Tot	BOD, OOD, SS, TS, Alk, Cond, pH, Cl, Sulf, O&G	TKN, NH ₃ -N, NO ₃ -N, Tot P	Al, Cd, Cr, Cu, Fe Pb, Mn, Ag, Zn, Hard	VOA, A+B/N, PCB
Fish Tissue	--	--	--	Al, Cd, Cr, Cu, Fe, Pb, Hg, Mn, Ni, Zn	% Lipids, PCB

TABLE 2 (CONTINUED)

Key

<u>Bacteria</u>		<u>Metals</u>	
Fec	fecal coliform	Al	Aluminum
Tot	total coliform	Cd	Cadmium
		Cr	Chromium
		Cr (VI)	Chromium +6
		Cu	Copper
		Fe	Iron
		Pb	Lead
		Hg	Mercury
		Mn	Manganese
		Ag	Silver
		Zn	Zinc
		As	Arsenic
		Ba	Barium
		Hard	Hardness
		EP Tox	EP Toxicity
<u>Physical/Chemical</u>		<u>Organics</u>	
SS	suspended solids	VOA	Volatile organics
TS	total solids	A+B/N	Acid and base/neutral extractables
Alk	total alkalinity	PCB	PCB and chlorinated pesticides
Turb	turbidity		
Cond	specific conductivity		
Cl	chloride		
BOD	Five-day biochemical oxygen demand		
COD	Chemical Oxygen Demand		
Sulf	Sulfate		
O&G	Oil and Grease		
TVS	Total volatile solids		
<u>Nutrients</u>			
TKN	Total Kjeldahl Nitrogen		
NH3-N	Ammonia-nitrogen		
NO3-N	Nitrate-Nitrogen		
Tot P	Total phosphorus		

Groundwater

On December 13, TSB personnel conducted split sampling with Standard Methods, Inc. for chemistry, nutrients, and metals at the nine monitoring wells shown in Figure 2. A pumping process was initiated before each well was sampled, consisting of pumping or bailing groundwater until a constant conductivity was measured by a YSI 3000 TLC analyzer. Samples were then collected using the bailer and placed in pre-washed containers. The analyses performed are presented in Table 2. Metals and nutrient samples were fixed in the field. The depth to groundwater ranged from 12 feet to 16 feet.

Leachate Treatment System

Leachate treatment system sampling was conducted on October 6, 1988 by personnel of the Technical Assistance and Training Section during a period when a once or twice per year batch discharge was occurring. On that day, lagoon 2 was empty. Lagoon 1 was aerated, although no removal was occurring. Treatment of the leachate was exhibited in lagoons 3, 4, and 6. Therefore, grab samples were taken from the influent and lagoons 3, 4, and 6 on each end as denoted by "A" or "B" in Figure 2. Samples were collected in pre-washed containers. The parameters sampled are shown in Table 2. Metals, nutrients and oil & grease samples were fixed in the field.

Fish

Fish sampling, scheduled to be conducted in the spring of 1989, was postponed until the summer. This was because the Division of Fisheries and Wildlife stocks the pond annually in the spring with hatchery-raised trout on a "put and take" basis for sportfishing. The application of TSB routine sampling techniques (i.e., gillnetting, electroshocking) may have resulted in the inadvertent collection and damage of these trout, thus adversely impacting this resource for fishermen.

On June 7, 1989 the pond was sampled with gill nets which were set and checked every two hours. Rod and reel sampling was performed during the interim time between net checks to supplement the sample. Gill net sampling provided a rather poor sample. Only four bluegills (Lepomis macrochirus) of a large enough size for analysis were collected. Electrofishing was conducted on June 15, 1989 utilizing a shock-boat and technical assistance provided by the Division of Fisheries and Wildlife. Electroshocking was conducted along the entire shoreline of the pond as well as in the Ware River upstream to the small dam, a distance of approximately 200 yards. The electrofishing resulted in a much more representative sample. Eight species were collected, including a wide range of trophic levels consisting of bottom feeders, forage species, and top level predators (see Table 3). Upon capture, all fish sampled were placed on ice in a cooler to be transported to the Technical Services Branch in Westborough for further processing.

As expected, most of the stocked trout had been caught, and none were collected during our sampling efforts.

TABLE 3
1989 POWERMILL POND FISH TOXICS MONITORING
LIST OF SPECIES OBSERVED

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>SPECIES CODE</u>
<u>Esox niger</u>	chain pickerel	CP
<u>Catostomus commersoni</u>	white sucker	WS
<u>Ictalurus nebulosus</u>	brown bullhead	BB
<u>Lepomis macrochirus</u>	bluegill	B
<u>Micropterus salmoides</u>	largemouth bass	LMB
<u>Pomoxis nigromaculatus</u>	black crappie	BC
<u>Perca flavescens</u>	yellow perch	YP
<u>Erimyzon oblongus</u>	creek chubsucker	CCS

Upon return to TSB, each fish was properly identified to the species level and assigned a sample number. Each fish was weighed (± 10 g) measured for total length (± 1 mm), and recorded on the standard TSB Fish Collection and Inventory Sheet (see Table 4). All fish were then filleted on a clean sheet of glass conforming to the Biomonitoring Program 1989 Standard Operating Procedures. This technique excludes the head section and any skeletal, visceral, or dermal tissue leaving a skinless, boneless fillet. Between each sample filleted, the fillet knife and cutting surface were rinsed with tap water to remove most of the residue from the previous sample and then rinsed with distilled deionized water. Appropriate aging structures (i.e., scales or pectoral fin spines) were removed from each fish and placed in separate labeled envelopes for drying and future age determination. The filleting process yielded two equivalent sections; one to be analyzed for metals, the other for percent lipids and organic contamination. The analyses conducted on fish fillets are shown in Table 2.

TABLE 4

1989 POWDERMILL POND FISH TOXICS MONITORING

SPECIES, LENGTH, WEIGHT AND AGE DATA

SAMPLE CODE	SPECIES CODE ¹	LENGTH (cm)	WEIGHT (g)	AGE (yrs)
PPF89-01	B	21.3	200	6+
PPF89-02	B	21.6	200	6+
PPF89-03	B	20.9	200	7+
PPF89-04	B	20.4	190	7+
PPF89-05	B	20.0	180	6+
PPF89-06	LMB	38.1	780	4+
PPF89-07	LMB	39.8	880	4+
PPF89-08	LMB	37.0	840	5+
PPF89-09	YP	22.6	120	5+
PPF89-10	YP	21.0	120	5+
PPF89-11	YP	18.0	100	5+
PPF89-12	YP	19.0	90	5+
PPF89-13	YP	19.0	90	4+
PPF89-14	YP	21.2	120	5+
PPF89-15	BB	23.4	260	3+
PPF89-16	BB	26.6	260	*
PPF89-17	BB	26.9	280	*
PPF89-18	WS	38.9	680	3+
PPF89-19	WS	35.3	480	2+
PPF89-20	WS	38.7	620	2+
PPF89-21	WS	36.4	500	2+
PPF89-22	LCS	23.8	220	2+
PPF89-23	CP	31.0	160	*

1 - refer to Table 3

* Not aged due to equipment constraints

DATA ANALYSIS

Surface Water and Sediment

The water quality survey conducted on October 18 characterized the pond as mesotrophic with sparse aquatic vegetation. A mesotrophic lake is in the intermediate stage in the eutrophication process between oligotrophic and eutrophic. Eutrophication is the natural or artificial addition of nutrients to bodies of water and the effects of the added nutrients. Accelerated eutrophication due to man's activities, or cultural eutrophication, is the excessive addition of inorganic nutrients, organic matter, and silt to lakes, leading to increased biological production and a corresponding decrease in volume. An oligotrophic lake is usually deep, has nutrient poor sediments, few macrophytes, and high dissolved oxygen in the deepest water. Eutrophic lakes are high in nutrients and organic matter, more shallow, more rich in plankton and macrophytes, and have depleted dissolved oxygen levels in bottom waters. The placement in this category was based on nutrient levels, dissolved oxygen concentrations, and the extent of plant growth for the season. Phosphorus, an essential nutrient for plant and algae growth, was present in the moderate concentration range (0.01 mg/l to 0.05 mg/l, see Table 5). Nitrogen (ammonia-nitrogen plus nitrate-nitrogen) was present in the low range (less than 0.15 mg/l) at Stations 5 and 6, in the high range (0.3 mg/l to 0.5 mg/l, mostly ammonia-nitrogen) at Station 2, and in the severe level (greater than 0.5 mg/l) at Station 4.

The field pH in the water column was low (4.0 - 5.2, see Table 6) indicating that the pond is very acidic. The low pH probably resulted from rainfall on the previous day and the very low alkalinity of 6.3 mg/l to 8.0 mg/l. Specific conductivity measurements were uniform (62-72 $\mu\text{mhos/cm}$). Only "Barre Brook" exhibited a higher conductivity (110 $\mu\text{mhos/cm}$), but still much lower than that in the groundwater (936 $\mu\text{mhos/cm}$). Dissolved oxygen concentrations were uniform both upstream and downstream of the landfill. The concentrations at stations 2, 6, and 7 were 9.9-10.0 mg/l, representing 86-88 percent saturation. Dissolved oxygen concentrations were lower adjacent to the landfill. At Stations 4 and 5 the concentrations were 8.0-8.4 mg/l, representing 72-74 percent saturation. "Barre Brook" exhibited the lowest dissolved oxygen concentration of 7.4 mg/l, representing 69 percent saturation at Station 3. These lower dissolved oxygen concentrations are possibly due to the impact of organic loadings from the landfill.

Metals concentrations in the water column (see Table 7) show that EPA "Gold Book" water quality criteria for copper was exceeded at each station with a maximum concentration of 0.88 mg/l at Station 2. The lead concentration at station 1 in the Ware River (0.013 mg/l) was only 0.01 mg/l below the "Gold Book" water quality criteria. The lower copper and lead concentrations at the stations opposite to the landfill show that on the day sampled, the landfill did not impact the pond. However, iron exceeded the "Gold Book" water quality criteria of 1.0 mg/l at Station 4. No volatile organic or extractable compounds were found in any detectable concentration in the pond (see Table 8). Benzene was detected at Station 7 at a concentration of less than 1.0 $\mu\text{g/l}$.

TABLE 5
MARTONE LANDFILL EVALUATION
SURFACE WATER SAMPLING

Water Quality Data¹

(All data in mg/l unless otherwise noted)

PARAMETERS	SAMPLING STATIONS						
	1	2	3	4	5	6	7
Alkalinity	6.9	6.4	8.0	7.7	6.7	6.3	6.6
Hardness	11	11	18	15	11	11	10
Turbidity (NTU)	1.2	1.2	0.8	1.9	1.4	1.2	1.3
Color (units)	70	70	40	90	80	60	70
Suspended Solids	4.0	1.0	4.0	4.0	2.0	2.0	2.0
Total Solids	52	58	82	64	56	58	52
Chloride	8.0	9.0	13	9.0	9.0	9.0	9.0
Total Kjeldahl-Nitrogen	0.45	0.55	0.22	1.6	0.46	0.30	0.25
Ammonia-Nitrogen	0.02	<0.02	<0.02	0.36	0.05	0.02	0.02
Nitrate-Nitrogen	<0.1	0.3	<0.1	4.2	0.1	0.1	<0.1
Total Phosphorus	0.05	0.03	0.04	0.05	0.04	0.04	0.04
Volatile organics (µg/l)	ND	ND	ND	ND	ND	ND	<1.0*
Base Neutral Extractables (µg/l)	--	--	ND	ND	ND	--	--
Acid Extractables (µg/l)	--	--	ND	ND	ND	--	--

1 Survey Date: October 18, 1988

* Benzene

TABLE 6
MARTONE LANDFILL EVALUATION
SURFACE WATER SAMPLING
Physical/Chemical Parameters¹

SAMPLING STATION	TEMPERATURE (°C)	pH (Standard Units)	DISSOLVED OXYGEN (mg/l)	SPECIFIC CONDUCTIVITY (μmhos/cm)
1	10.4	3.8*/6.9**	9.0	58
2	9.7	4.3/6.1	10.0	62
3	12.5	5.2/6.2	7.4	106
4	10.8	4.1/6.1	8.0	72
5	9.9	4.0/6.1	9.4	66
6	9.9	4.1/6.1	9.9	63
7	9.2	4.2/6.1	9.9	63

1 Survey Date: October 18, 1988

* Field (Hydrolab)

** Laboratory

TABLE 7
MARTONE LANDFILL EVALUATION
SURFACE WATER SAMPLING
Total Metals Data (mg/l)^{1,2}

PARAMETERS	SAMPLING STATIONS						
	1	2	3	4	5	6	7
Aluminum	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Chromium (VI)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.022	0.88	0.016	0.016	0.014	0.010	0.007
Iron	0.66	0.62	0.20	1.9	0.96	0.76	0.88
Lead	0.013	0.002	<0.002	0.002	<0.002	<0.002	<0.002
Manganese	0.03	0.03	<0.02	0.10	0.03	0.03	0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Silver	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001
Zinc	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

1 Survey Date: October 18, 1988

2 Chromium in both total and +6 valence forms

TABLE 8
MARTONE LANDFILL EVALUATION
IN-LAKE SEDIMENT SAMPLING

Total Metals and Nutrients Data

(All units in mg/kg unless otherwise noted)

PARAMETERS	SAMPLING STATIONS			314 CMR-9 CATEGORY I SEDIMENT CRITERIA
	2	4	5	
Aluminum	8,950	12,700	10,600	--
Arsenic	--	4.0	3.5	<10.0
Cadmium	1.0	1.0	1.0	<5.0
Chromium	8.0	7.5	6.5	<100
Copper	11	13	17	<200
Lead	65	24	45	<100
Mercury	0.09	0.095	0.245	<0.5
Nickel	8.5	12	8.5	<50
Silver	<1.0	<1.0	<1.0	--
Zinc	95	80	95	<200
E.P. Toxicity (mg/l)				
Cadmium	<0.02	<0.02	<0.02	--
Chromium	<0.03	<0.03	<0.03	--
Lead	0.40	0.06	0.05	--
Mercury	0.0015	0.0008	0.0003	--
Total Volatile Solids (%)	15	33	13	--
Total Kjeldahl Nitrogen	8,640	9,810	4,590	--
Total Phosphorus	970	1,460	1,180	--

1 Survey Date: October 18, 1988

Sediment metals concentrations were compared to the State Criteria for Dredge and Fill Material (314 CMR-9.00), provided as Appendix C. These criteria are usually consulted if dredging is proposed as a remedial action. This comparison showed that all metals concentrations were all below the Category I sediment criteria (see Table 7). Therefore for the date sampled, sediments have not been impacted by metals coming from the landfill.

Volatile organics were found only at Station 5 (see Table 9). Five base/neutral extractables were reported at Station 2 at concentrations less than the detection limits. Two additional extractables were identified, but not quantified. Only pyrene and fluoranthene were reported at Stations 4 and 5. The concentration of PCB's at Station 2 (0.45 $\mu\text{g/l}$) was the only one reported above its detection limit (0.17 $\mu\text{g/l}$). This concentration is also below the Category I sediment criteria of 0.5 mg/kg. For the date sampled, the landfill leachate did not seem to impact the pond sediments.

Groundwater

From the arrangement of the monitoring wells, the potential source of any impact can be determined as follows:

<u>WELL ID</u>	<u>SOURCE</u>	<u>IMPACT</u>
W3, MWA	Closed Landfill	Pond
MWB,MWC	Active Landfill	Pond
W1	Active Landfill, Runoff	Martone water supply
MWD,MWE,MWF	Area upgradient of Landfill	--

The closed landfill is potentially impacting the groundwater as demonstrated by the highest concentrations of phosphorus at monitoring well MWA, and COD, iron and aluminum at both monitoring wells; and high concentrations of manganese at monitoring wells W3 and MWA (see Tables 10 and 11). The active landfill is apparently impacting the groundwater as demonstrated by high concentrations of the same parameters plus a highest concentration of ammonia at monitoring well MWB. The groundwater upgradient of the landfill is impacted as demonstrated by the highest concentrations of five-day BOD at monitoring wells MWD and MWF (at much lower COD concentrations than at monitoring wells MWB, MWC, W3, and MWA), the highest copper concentration at monitoring well MWF, and high concentrations of aluminum and iron at monitoring wells MWD and MWE. The Martone water supply (well W1) on the west side was impacted only by a high manganese concentration of 1.9 mg/l.

The active landfill is potentially impacting the groundwater as demonstrated by the presence of 11 volatile organic compounds (VOA's) at monitoring well MWB (see Table 12). Only diethyl ether was present at a large peak. At monitoring well MWC, 1,1,1-trichloroethane (14 $\mu\text{g/l}$), 1,1-dichloroethane (8 $\mu\text{g/l}$), and a small peak of fluorotrichloromethane were detected. These VOA's which were absent in MWB were the only ones detected at MWC. The reason for the difference in the organic species in monitoring wells MWB and MWC is not known. A base/neutral extractable and an acid extractable were found at monitoring well MWB. The acid

TABLE 9
MARTONE LANDFILL EVALUATION
IN-LAKE SEDIMENT SAMPLING
Organics Data (mg/kg)^{1,2}

PARAMETERS	SAMPLING STATIONS		
	2	4	5
Methylene Chloride	ND	ND	6.4
Toluene	ND	ND	0.27
Phenanthrene	<5.2	ND	ND
Pyrene	<3.2	<3.2	<3.2
Fluoranthene	<4.0	<4.0	<4.0
Chrysene	<1.5	ND	ND
Benzo (a) anthracene	<2.4	ND	ND
Tridecane	*	ND	ND
1-methyl, 7-methylethyl phenanthrene	*	ND	ND
PCB 1260	0.45	<0.17	<0.17
Pesticides	ND	ND	ND

1 Survey Date: October 18, 1988

2 Several unidentified compounds detected at each station.

ND = Not Detected

* No standard available for quantification. The mass spectrum was compared to a mass spectral data base for identification.

TABLE 10

MARTONE LANDFILL EVALUATION

GROUNDWATER SAMPLING

Chemistry and Bacteria Data
(All data in mg/l unless otherwise noted)

PARAMETERS	WELL IDENTIFICATION								
	MWB	MWC	W3	MWA	W1	W4	MWE	MWF	MWD
COD	130	94	200	200	40	--	27	63	40
BOD ₅	13	14	9.6	13	1.2	--	3.6	30	24
Alkalinity	15	210	60	14	10	--	12	7	6
pH (standard units)	5.3	6.3	6.1	5.5	5.4	--	5.3	5.2	4.9
Hardness	104	87	94	63	52	--	23	16	66
Suspended Solids	2,000	1,600	4,600	3,100	8.5	--	3,200	120	2,300
Total Solids	2,300	2,000	4,900	3,200	230	--	3,300	160	2,500
Specific Conductivity (μ mhos/cm)	936	635	411	178	374	--	58	63	63
Chloride	55	55	5.0	6.0	66	--	3.0	1.0	2.0
Total Kjeldahl Nitrogen	38	4.9	7.1	4.4	0.48	--	0.78	0.60	1.3
Ammonia-Nitrogen	32	1.2	0.51	0.19	0.06	--	0.05	0.03	0.06
Nitrate-Nitrogen	0.1	<0.1	<0.1	0.1	0.5	--	0.4	0.1	0.5
Total Phosphorus	5.0	5.5	1.8	8.7	0.20	--	3.0	0.34	4.3
Total Coliform/100ml	<10	<10	<10	<10	<10	60	<10	<10	<10
Fecal Coliform/100ml	<5	<5	<5	<5	<5	<5	<5	<5	<5

TABLE 11

MARTONE LANDFILL EVALUATION

GROUNDWATER SAMPLING

Total Metals Data (mg/l)^{1,2}

WELL IDENTIFICATION

PARAMETERS	MWB	MWC	W3	MWA	W1	MWE	MWF	MWD
Aluminum	25	22	150	43	0.44	38	0.61	41
Arsenic	0.066	0.041	0.384	0.027	<0.001	0.009	<0.001	0.008
Barium	0.19	0.21	0.50	0.34	<0.05	0.24	<0.05	0.39
Cadmium	0.003	<0.001	0.002	0.003	<0.001	0.005	0.003	0.002
Chromium	<0.03	<0.03	0.17	0.08	<0.03	0.05	<0.03	0.08
Chromium (VI)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.07	0.07	0.17	0.07	0.02	0.06	0.79	0.07
Iron	140	84	380	143	0.60	49	1.4	82
Lead	0.03	0.073	0.087	0.031	<0.002	0.016	0.016	0.025
Manganese	1.4	3.0	2.5	0.97	1.9	0.47	0.04	0.81
Mercury	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	0.03	0.06	0.05	0.04	0.06	0.07	<0.03	<0.03
Silver	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	0.13	0.07	0.31	0.20	0.06	0.16	0.04	0.22

1 Survey Date: December 13, 1988

2 Chromium in both total and +6 valence form

TABLE 12
MARTONE LANDFILL EVALUATION

GROUNDWATER SAMPLING

Organic Data ($\mu\text{g/l}$)¹

PARAMETERS	WELL IDENTIFICATION							
	MWB	MWC	W3	MWA	W1	MWE	MWF	MWD
Benzene	1.1	ND	ND	ND	ND	ND	ND	ND
1,1 Dichloroethane	<1.0	8	ND	ND	ND	ND	ND	ND
1,2 Dichloroethylene	<1.0	ND	ND	ND	ND	ND	ND	ND
Diethyl ether	* ²	ND	ND	ND	ND	ND	ND	ND
Dichlorofluoromethane	*	ND	ND	ND	ND	ND	ND	ND
Butane	*	ND	ND	ND	ND	ND	ND	ND
Butene	*	ND	ND	ND	ND	ND	ND	ND
Butanol	*	ND	ND	ND	ND	ND	ND	ND
Cycloheptane	*	ND	ND	ND	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	14	ND	ND	ND	ND	ND	ND
Fluorotrichloromethane	ND	*	ND	ND	ND	ND	ND	ND
Hydroxyethylidocenamide	*	ND	ND	ND	ND	ND	ND	ND
Hexadecanoic Acid	*	ND	ND	ND	ND	ND	*	ND
Pentachlorophenol	ND	ND	ND	ND	ND	ND	*	ND
PCB 1242	ND	ND	6.4	ND	6.3	6.5	6.5	ND
PCB 1254	ND	ND	7.7	ND	5.9	5.9	3.3	ND
PCB 1260	ND	ND	5.0	ND	4.9	3.5	2.2	ND

ND = Not Detected

1 Survey Date: December 13, 1988

2 Large Peak

* No standard available for quantification. The mass spectrum was compared to a mass spectral data base for identification.

extractable, hexadecanoic acid was also detected in monitoring well MWF. Another acid extractable, pentachlorophenol, was found only at monitoring well MWF. PCB's were found in the Martone water supply well W1, upgradient wells MWE and MWF, and in monitoring well W3. The source of the PCB's in well W1 is not certain. A possible explanation of the PCB's in the wells upgradient from the landfill is their location one-quarter mile downgradient from New England Power Company power lines and a transformer. However, PCB's may just be ubiquitous in the environment.

Leachate Treatment System

Significant removal of five-day BOD, COD, and ammonia-nitrogen occurred in lagoon 3, while the phosphorus and sulfate concentrations increased (see Table 13). The phosphorus concentration then decreased in lagoon 4 while the sulfate concentration remained high. Total coliform counts were very high in lagoon 3, but densities were much lower in lagoons 4 and 6. Significant five-day BOD and COD removal did not occur in lagoons 4 and 6. However, suspended solids removal occurred in lagoon 4.

Almost complete removal of iron and manganese occurred in the lagoons (see Table 14). These were the only metals having a significant incoming concentration. The lead concentration increased in discharge lagoon 6 from less than 0.05 mg/l to 0.08 mg/l. No organics were detected in the lagoons. However, several unidentified extractables were present in the influent (see Table 15).

Fish

Metals data for the twelve samples were received from LES on July 24, 1989. Results of the organic scan analysis were received from LES on August 3, 1989.

The following is a list of mean values and ranges of values for the metals data reported from the lab (see Table 16). Cadmium and lead were omitted from the listing because all the values reported were below their detection limits of 0.20 mg/kg and 0.50 mg/kg, respectively. Means for aluminum and chromium were not calculated because an insufficient number of samples were above their detection limits of 1.0 mg/kg, and 0.30 mg/l, respectively. Values that were below the detection limits were multiplied by a factor of 0.5 to be included in the calculation of the mean.

<u>METAL</u>	<u>MEAN (mg/kg)</u>	<u>RANGE (mg/kg)</u>
aluminum	--	<1.00 - 2.0
chromium	--	<0.30 - 0.40
copper	1.60	0.20 - 11.0
iron	4.60	1.90 - 11.0
mercury	0.57	0.20 - 0.88
manganese	0.40	<0.20 - 0.70
nickel	0.87	<0.30 - 4.20
zinc	4.79	3.30 - 11.0

Metals data from Powder Mill Pond fish samples were compared to data from over one thousand fish samples collected state-wide from inland waters as part of the MDWPC toxics in fish monitoring program.

TABLE 13
MARTONE LANDFILL EVALUATION
LEACHATE TREATMENT SYSTEM SAMPLING
Chemistry and Bacteria Data¹

(All data in mg/l unless otherwise noted)

PARAMETERS	LAGOON IDENTIFICATION						
	INFL	3A	3B	4A	4B	6A	6B
COD	5,100	370	390	180	18	210	216
BOD ₅	230	12	36	6.0	15	16	14
Alkalinity	1,720	400	500	480	420	340	570
Suspended Solids	130	160	160	18	38	40	28
Total Solids	5,300	1,500	1,500	1,400	1400	1,100	1,100
Specific Conductivity (μ mhos/cm)	5,300	1,530	1,530	1,740	1,753	1,224	1,224
Chloride	430	220	220	240	240	180	180
Total Kjeldahl Nitrogen	230	21	14	11	10	7.6	7.8
Ammonia-Nitrogen	117	0.39	0.28	7.5	3.8	0.23	0.08
Nitrate-Nitrogen	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Phosphorus	0.15	3.0	3.0	0.30	0.25	0.25	0.25
Sulfate	11	70	75	95	20	80	80
Oil and Grease	--	--	2.1	--	1.9	--	2.4
Total Coliform/100ml	--	--	240,000	--	230	--	430
Fecal Coliform/100ml	--	--	230	--	<36	--	36

¹ Survey Date: October 6, 1988

TABLE 14
MARTONE LANDFILL EVALUATION
LEACHATE TREATMENT SYSTEM SAMPLING
Total Metals Data (mg/l)¹

PARAMETERS	LAGOON IDENTIFICATION						
	INFL	3A	3B	4A	4B	6A	6B
Aluminum	<0.10	<0.10	<0.10	<0.10	0.13	<0.10	<0.10
Cadmium	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chromium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Copper	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Iron	46	0.40	2.2	0.10	0.11	0.03	0.02
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.08
Manganese	4.0	0.05	0.16	0.07	0.07	0.02	0.02
Nickel	0.03	0.03	0.03	0.03	0.03	0.03	<0.03
Silver	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Zinc	0.10	0.02	0.03	<0.02	0.13	<0.02	0.05
Sodium	320	180	176	120	200	140	170

¹ Survey Date: October 6, 1988

TABLE 15
MARTONE LANDFILL EVALUATION
LEACHATE TREATMENT SYSTEM SAMPLING
Organic Data ($\mu\text{g/l}$)¹

PARAMETERS	LAGOON IDENTIFICATION			
	INFL	3	4	6
Volitile Organics	ND	ND	ND	ND
Acid Extractables	*	ND	ND	ND
Base/Neutral Extractables	*	ND	ND	ND
PCB's	ND	ND	ND	ND
Pesticides	ND	ND	ND	ND

1 Survey Date: October 6, 1988

ND = Not Detected

* Several Unidentified Compounds

TABLE 16

1989 POWDERMILL POND FISH TOXICS MONITORING

RESULTS OF METALS ANALYSES

SAMPLE CODE	SPECIES CODE ¹	SAMPLE TYPE	Metals Concentration (mg/kg wet weight)									
			Al	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn
PPF89-01-05	B	Composite	<1.0	<0.20	<0.30	0.30	3.5	0.55	0.40	<0.30	<0.50	3.9
PPF89-06	IMB	Individual	<1.0	<0.20	<0.30	0.60	1.9	0.70	<0.20	<0.30	<0.50	3.8
PPF89-07	IMB	Individual	<1.0	<0.20	<0.30	0.50	3.2	0.87	0.30	<0.30	<0.50	3.4
PPF89-08	IMB	Individual	2.0	<0.20	<0.30	0.40	3.1	0.88	0.30	0.40	<0.50	3.8
PPF89-09-10	YP	Composite	<1.0	<0.20	<0.30	0.20	2.4	0.53	0.40	0.40	<0.50	3.3
PPF89-11-14	YP	Composite	<1.0	<0.20	<0.30	0.90	4.5	0.60	0.45	3.2	<0.50	4.1
PPF89-15	BC	Individual	<1.0	<0.20	<0.30	11.0	11.0	0.53	0.30	4.2	<0.50	11.0
PPF89-16-17	BB	Composite	<1.0	<0.20	0.40	1.0	7.7	0.31	0.40	0.40	<0.50	4.5
PPF89-18	WS	Individual	<1.0	<0.20	0.40	0.80	6.1	0.47	0.50	<0.30	<0.50	4.5
PPF89-19-21	WS	Composite	<1.0	<0.20	<0.30	0.80	5.9	0.45	0.60	<0.30	<0.50	4.5
PPF89-22	CCS	Individual	1.0	<0.20	<0.30	2.3	4.1	0.20	0.70	0.90	<0.50	6.2
PPF89-23	CP	Individual	<1.0	<0.20	<0.30	0.40	2.2	0.70	0.40	<0.30	<0.50	4.5

1 - refer to Table 3

Mean values in Powder Mill Pond fish samples for cadmium, iron, nickel, lead, and zinc were all below the state-wide database averages. The mean value for copper (1.6 mg/kg) slightly exceeded the state-wide average of 1.54 mg/kg. One outlying value of 11.0 mg/kg raised the mean considerably. If this value were omitted from the calculation of the mean, the mean value for copper in Powder Mill Pond would fall well below the state-wide mean. The mean values for mercury (0.57 mg/kg) and manganese (0.40 mg/kg) exceeded the state-wide averages of 0.332 mg/kg and 0.30 mg/kg, respectively. The Federal Food and Drug Administration (FDA) maintains an action level of 1.0 mg/kg of mercury² which applies to the interstate sale of fish for consumption.

The organic scan analysis resulted in the detection of PCB arochlor 1260 in all twelve samples (see Table 17). Five were reported to be below the detection limit of 0.036 mg/kg. All remaining values ranged between 0.036 mg/kg and 0.076 mg/kg. Percent lipids for the twelve samples ranged between 0.079 and 0.72 with a mean value of 0.37. The FDA also^a maintains an action level of 2.0 mg/kg for PCB's in fish tissue³ for consumption.

TABLE 17

1989 POWDERMILL POND FISH TOXICS MONITORING

PERCENT LIPIDS AND ORGANIC SCAN RESULTS

SAMPLE CODE	SPECIES CODE ¹	SAMPLE TYPE	% LIPID	PCB Archlor (mg/kg) 1260
PPF89-01-05	B	Composite	0.23	0.036
PPF89-06	IMB	Individual	0.26	0.039
PPF89-07	IMB	Individual	0.34	0.039
PPF89-08	IMB	Individual	0.35	<0.036
PPF89-09-10	YP	Composite	0.29	<0.036
PPF89-11-14	YP	Composite	0.28	<0.036
PPF89-15	BC	Individual	0.12	<0.036
PPF89-16-17	BB	Composite	0.71	<0.036
PPF89-18	WS	Individual	0.59	0.043
PPF89-19-21	WS	Composite	0.72	0.046
PPF89-22	CCS	Individual	0.47	0.060
PPF89-23	CP	Individual	0.079	0.560

1 refer to Table 1

CONCLUSIONS

During both this study and past sampling, groundwater has apparently been impacted by both the closed and the active landfill sites. High concentrations of iron, manganese, COD, five-day BOD, and total phosphorus were observed in downgradient monitoring wells MWB, MWC, W3, and MWA. However, high ammonia-nitrogen concentrations occurred only in MWB. Low concentrations of volatile organics are attributed to the active landfill site. However, MWB and MWC have exhibited different organic species. Monitoring wells MWB and MWC are located closer to Powder Mill Pond than wells W3 and MWA. However, monitoring wells W3 and MWA have possibly been impacted longer, since the closed landfill has been in place longer. Therefore, contaminants could break out along the shoreline across from the closed site before they emerge across from the active landfill.

The Martone water supply well (W1) has exhibited high concentrations of manganese and PCB's. PCB's detected at monitoring well W3 have potentially been migrating from the closed landfill site. However, they were not detected at monitoring well MWA. Upgradient groundwater was impacted by high concentrations of manganese, iron, five-day BOD, and total phosphorus, and PCB's.

At this time the increased contaminant concentrations in groundwater have not resulted in an impact on the water quality of Powder Mill Pond, except for an elevated nitrogen concentration, mostly nitrate, and an elevated iron concentration at Station 4. Station 5 was not impacted, although both stations are close to the landfill. Sediment quality has not been affected.

On the day sampled, the leachate treatment system was effective in removing significant components of the leachate (five-day BOD, COD, ammonia-nitrogen, suspended solids, iron, and manganese).

In fish samples, mean values for mercury and manganese were above the state averages computed from one thousand fish samples collected from inland waters state-wide by MDWPC. The slightly elevated manganese values accumulated in fish tissues (0.40 mg/kg compared to 0.30 mg/kg) appear to be congruent with manganese contamination in the water column and groundwater associated with the landfill. Although the USFDA action level of 1.0 mg/kg for mercury in fish flesh was not exceeded by any of the samples tested, the data seem to be consistent in demonstrating slightly elevated levels of mercury in Powder Mill Pond fish.

In fish, the PCB 1260 values were considered very low. The highest reported tissue burden (0.56 mg/kg) was from an individual chain pickerel. Pickerel represent the highest trophic level of the fish sampled, thus depicting the greatest bioaccumulation potential. The next highest PCB value was 0.06 mg/kg with all others below this level. All PCB concentrations in fish were well below the 2.0 mg/kg FDA action level.

In general, bioaccumulation of toxic metals and PCBs in fish from Powder Mill Pond does not demonstrate a major problem of contamination to the pond from the Martone landfill. Observable outbreaks of leachate are entering the pond from the landfill. Apparently this leachate is not presently causing significant bioaccumulation of contaminants in fish flesh.

RECOMMENDATIONS FOR FUTURE STUDY

In order to prevent contaminated groundwater from impacting Powder Mill Pond, the rate and direction of groundwater movement from both the closed and the active landfill site must be determined. Future monitoring of groundwater close to the closed landfill site will also determine whether contaminated leachate is still migrating from these sites. Seasonal monitoring of Powder Mill Pond water and sediment should continue to document future impacts of landfill leachate. Measures to control both the movement of contaminated groundwater and the potential migration of leachate from the landfill sites would then be developed. Sampling at all monitoring wells and the pond would continue until these measures were implemented.

The impact of the New England Power Company's transformer on the groundwater upgradient of the landfill must be determined similarly by sampling groundwater between the transformer and the landfill and determining the rate and direction of groundwater flow. Depending on the direction of groundwater movement, monitoring wells may be required to determine the direction from which the contaminated groundwater is coming and potential sources of the contamination.

The source of PCB's in the Martone water supply well W1 must be controlled or eliminated.

REFERENCES

1. U.S. Environmental Protection Agency. 1986. Quality Criteria for Water. EPA-440/9-76-023
2. U.S. Food and Drug Administration. 1982. Levels for poisonous or deleterious substances in human food and animal feed. U. S. FDA, Washington DC. 13 pp.
3. U.S. Food and Drug Administration. 1984. Polychlorinated biphenyl's (PBCs) in fish and shellfish; reduction of tolerances; final decision. U.S. FDA, Rockville, MD. Federal Register, Vol. 49, No. 100. pp. 21514-21520.

APPENDIX A

MARTONE LANDFILL AND POWDER MILL POND STUDY

BOTTLE PREPARATION

<u>PARAMETER</u>	<u>BOTTLE SIZE</u>	<u>CLEANING PROCEDURE</u>	<u>FIXING PROCEDURE</u>
Physical/Chemistry Hexavalent Chromium	1/2 gal	Soap; distilled/deionized rinse 3x	-----
Nutrients and hardness	16 oz	Soap; distilled/deionized rinse 3x	2 ml 1:1 H ₂ SO ₄ , teflon or plastic wrap under cap
Metals	16 oz	Soap; 1:1 HCl rinse; 1:1 HNO ₃ rinse; distilled/deionized rinse 2x	2 ml 1:1 HNO ₃ , teflon or plastic wrap under cap
Bacteria	autoclaved from Lawrence Experiment Station		-----
VOA's ¹	from Lawrence Experiment Station		-----
Base Neutral and Acid Extractables	from Lawrence Experiment Station		Cap with teflon
PCB's and Pesticides	from Lawrence Experiment Station		Cap with teflon
Oil and Grease	1/2 gal	Soap; 1:1 H ₂ SO ₄ , distilled/ deionized rinse 3x	Teflon lined screw top
Sediment nutrients and metals	plastic jars	Distilled/deionized rinse	-----
Sediment PCB's and PAH	from Lawrence Experiment Station		-----
Sediment VOA's	from Lawrence Experiment Station		-----

1 Two bottles per sample

APPENDIX B

ANALYTICAL METHODS USED AT LAWRENCE EXPERIMENT STATION

<u>PARAMETER</u>	<u>METHOD</u>	<u>REPORTED AS</u>
(Water Column)		
Dissolved Oxygen	Azide modification of Winkler method. 0.0375 N sodium thio-sulfate titrant, 300 ml sample EPA Method 360.2	mg/l D.O.
BOD	5-day oxygen depletion at 20°C EPA Method 405.1	mg/l BOD
pH	Electrometric, glass indicator, silver chloride reference EPA Method 150.1	pH Standard units
Total Alkalinity	0.02 N sulfuric acid potentiometric titration to pH 4.5, Orion Model 701, digital pH meter EPA Method 310.1	mg/l CaCO ₃
Suspended Solids	Filtration through standard glass fiber filter paper. Residue dried at 103-105°C. Gravimetric EPA Method 160.2	mg/l S.S.
Total Solids	Evaporation to dryness at 103-105°C. Gravimetric EPA Method 160.3	mg/l T.S.
Color	Visual comparison of sample with known concentrations of colored solutions	Color Units
Chloride	Argentometric (titration with silver nitrate) EPA Method 325.3	mg/l Cl
Specific Conductance	Wheatstone Bridge type meter. Yellow Springs Instrument conductivity bridge, Model 31 EPA Method 120.1	μmhos/cm

APPENDIX B (CONTINUED)

ANALYTICAL METHODS USED AT LAWRENCE EXPERIMENT STATION

<u>PARAMETER</u>	<u>METHOD</u>	<u>REPORTED AS</u>
(Water Column)		
Total Kjeldahl-Nitrogen	Acid digestion using Technicon BD-40 Block Digester. Colorimetric analysis (reaction of ammonia, sodium salicylate, sodium nitroprusside, and sodium hypochlorite in buffered alkaline medium) using Technicon Auto Analyzer II EPA Method 351.3	mg/l TKN
Ammonia-Nitrogen	Phenate method, automated. Colorimetric analysis using Technicon Auto Analyzer II EPA Method 350.1	mg/l NH ₃ -N
Nitrate-Nitrogen	Hydrazine reduction method, automated. Colorimetric analysis using Technicon Auto Analyzer II EPA Method 351.3	mg/l NO ₃ -N
Total Phosphorus	Acid digestion using Technicon BD-40 Block Digester. Ascorbic acid reduction colorimetric method using Technicon Auto Analyzer II EPA Method 365.4	mg/l P
COD	Dichromate reflux	mg/l COD
Fecal Coliform	Membrane filter technique	Fecal coliform /100 ml
Total Coliform	Membrane filter technique	Total coliform /100 ml
Total Oil and Grease	Partition-Gravimetric Method EPA Method 413.1	mg/l

APPENDIX B (CONTINUED)

ANALYTICAL METHODS USED AT LAWRENCE EXPERIMENT STATION

<u>PARAMETER</u>	<u>METHOD</u>	<u>REPORTED AS</u>
(Water Column)		
Aluminum	Inductively Coupled Argon Plasma technique (ICAP). Perkin Elmer EPA Method 200.7	mg/l
Arsenic	Atomic Absorption Spectrophotometry. Graphite furnace. Instrumentation Laboratory Model 951 EPA Method 206.2	mg/l
Cadmium, chromium, copper, iron, lead, nickel, silver, zinc, hardness (Ca+Mg)	Atomic Absorption Spectrophotometry. Air-acetylene flame. Perkin-Elmer Zeeman Model 5100 EPA Methods Cd - 213.2, Cr - 218.1, Cu - 220.1, Fe - 236.1, Pb - 239.1, Ni - 249.1, Ag - 272.1, Zn - 289.1	mg/l
Mercury	Cold Vapor Method EPA Method 245.1	mg/l
Volatile Organics	Purge and trap GC/MS EPA Method 624	µg/l
Acid and Base/Neutral Extractables	Extraction with methylene chloride followed by GC/MS EPA Method 625	µg/l
Polychlorinated biphenyls	Organochlorine Pesticides and PCBs. Extraction with methylene chloride followed by GC EPA Method 608	µg/l

APPENDIX B (CONTINUED)

ANALYTICAL METHODS USED AT LAWRENCE EXPERIMENT STATION

<u>PARAMETER</u>	<u>METHOD</u>	<u>REPORTED AS</u>
(Sediment)		
% Volatile Solids	Residue from Total Solids determination ignited at 550°C. Gravimetric EPA Method 160.4	% Volatile solids
Total Kjeldahl-Nitrogen	Acid digestion using Technicon BD-40 Block Digester. Colorimetric analysis (reaction of ammonia, sodium salicylate, sodium nitroprusside, and sodium hypochlorite in a buffered alkaline medium) using Technicon Auto Analyzer II EPA Method 351.3	mg/kg dry weight
Total Phosphorus	Acid digestion using Technicon BD-40 Block Digester. Ascorbic acid reduction colorimetric method using Technicon Auto Analyzer II EPA Method 365.4	mg/kg dry weight
Aluminum	Inductively Coupled Argon Plasma technique (ICAP). Perkin Elmer EPA Method 200.7	mg/kg dry weight
Arsenic, chromium, copper, lead, nickel, zinc	Atomic Absorption Spectrophotometry. Air-acetylene flame. Perkin-Elmer Zeeman Model 5100 EPA Methods As - 206.2, Cr - 218.1, Cu - 220.1, Ni - 249.1, Zn - 289.1	mg/kg dry weight
Mercury	Cold Vapor Method EPA Method 245.1	mg/kg dry weight
Polychlorinated biphenyls	Organochlorine Pesticides and PCBs SW-846 EPA Method 8080	µg/g dry weight
Polycyclic aromatic hydrocarbons	EPA Method 8270	µg/g dry weight

APPENDIX B (CONTINUED)

ANALYTICAL METHODS USED AT LAWRENCE EXPERIMENT STATION

<u>PARAMETER</u>	<u>METHOD</u>	<u>REPORTED AS</u>
(Fish Flesh)		
Aluminum	Inductively Coupled Argon Plasma technique (ICAP). Perkin Elmer EPA Method 200.7	mg/kg wet weight
Cadmium, chromium, copper, iron, lead, manganese, nickel, zinc	Atomic Absorption Spectrophotometry. Air- acetylene flame. Varian Model 1475. EPA Methods Cd - 213.2, Cr - 218.1, Cu - 220.1, Fe - 236.1, Pb - 239.1, Mn - 243.1, Ni - 249.1, Zn - 289.1	mg/kg wet weight
Mercury	Cold Vapor Method using a VGA 76 hydride generator for mercury	mg/kg wet weight
Organic scan for pesticides and PCBs and % lipids	Federal Food and Drug Procedure Pesticide Analytical Method 211.13f.	mg/kg wet weight

APPENDIX C

314 CMR 9.00: CERTIFICATION FOR DREDGING, DREDGED MATERIAL DISPOSAL AND FILLING IN WATERS

Section

- 9.01: General Provisions
- 9.02: Submission of Application
- 9.03: Criteria for Evaluation of Application
- 9.04: Water Quality Certification
- 9.05: Miscellaneous Provisions
- (314 CMR 9.06 through 9.89: Reserved)

9.01 General Provisions

- (1) Statutory Authority - These regulations are adopted by the Division pursuant to Section 27(12) of the Massachusetts Clean Waters Act, M.G.L. c. 21, ss. 26 - 53.

- (2) Scope and Purpose

- (a) These regulations are promulgated in order to establish procedures, criteria and standards for the uniform and coordinated administration of water quality certification of dredging and dredged material disposal and filling projects in waters of the Commonwealth. To ensure coordination between these regulations and the relevant policies, laws or programs of other EOEa agencies, the Division will issue a certification to such agencies regarding the consistency of any project with these regulations and the policies, plans and standards of the Division.

These regulations are intended to encompass dredging projects in the waters or wetland areas of the Commonwealth which are also subject to the jurisdiction of either a federal agency under Section 401 of the Federal Water Pollution Control Act, 33 U.S.C. 1341, or the Department under M.G.L. c. 131, s. 40 or M.G.L. c. 91.

- (b) Relationship to Section 401 of the Federal Water Pollution Control Act, as amended (33 U.S.C. 1341). Section 401 provides that any applicant for a federal license or permit to conduct any activity which may result in a discharge into the navigable waters of a State must provide the Federal licensing agency with a certification form that state's water pollution control agency that the proposed discharge will not violate applicable federal or state discharge limitations or water quality standards. Projects involving dredging, disposal of dredged material, and filling in navigable waters are subject to several federal licensing and/or permitting requirements and by their very nature involve discharge to the navigable waters. Thus, such federally licensed projects generally require a Section 401 certification by the appropriate state water pollution control agency.

The Division is responsible for issuing Section 401 certifications for federally licensed activities with discharges to the waters of the Commonwealth. (M.G.L. c. 21, s. 27).

These regulations establish the procedures whereby persons intending to dredge, dispose of dredged material or fill in the waters of the Commonwealth may apply for a Section 401 certification and the criteria to be applied by the Division in reviewing such applications. These regulations also address the requirements of Section 43 of the Massachusetts Act relative to these activities.

(c) Relationship of M.G.L. c. 21, s. 43 to Section 401, M.G.L. c. 131, s. 40 (Wetlands Protection Act) and M.G.L. c. 91 (Waterways). Projects subject to M.G.L. c. 131, s. 40 and M.G.L. c. 91 will in many cases result in the discharge of pollutants into the waters of the Commonwealth and as such require a permit from the Director pursuant to Section 43 of the Massachusetts Act. Section 43(2), however, authorizes the Director to exempt discharges from this permit requirement by the promulgation of a regulation.

Insofar as federally licensed projects are regulated by the Division through the Section 401 certification process, these projects are hereby exempted from the permit requirements of M.G.L. c. 21, s. 43, provided that such projects need either a Wetlands or Waterways permit.

Projects involving dredging, dredged material disposal and filling activities in wetlands subject to M.G.L. c. 131, s. 40 must obtain an Order of Conditions from the local Conservation Commission or a Superseding Order from the Department if the local order is appealed by any party, including the Department. If the dredging project is below the mean high water mark or in certain rivers, streams or ponds, a license or permit must be obtained from the Department's Division of Waterways pursuant to c. 91. For any project subject to M.G.L. c. 131, s. 40 or M.G.L. c. 91, and not also subject to Section 401, the Division will supply a water quality certification to the Department.

Insofar as the state-licensed projects are also regulated by the Division through a certification process, these projects are hereby exempted from the permit requirements of M.G.L. c. 21, s. 43, provided that such projects need either a Wetlands or Waterways Permit.

Projects which are neither licensed by the federal government nor by the Department are not subject to these regulations.

(d) Relationship to the Massachusetts Coastal Zone Management Program.

1. These regulations insofar as they apply to projects in the coastal zone are intended to be consistent with and form part of the Commonwealth's Coastal Zone Management Program (hereinafter

"CZM Program"), as it has been promulgated and defined by the regulations and amendments issued pursuant to M.G.L. c. 21A and entitled "Establishment of the Coastal Zone Management Program by the Executive Office of Environmental Affairs" (hereinafter "CZM Regulations", 301 CMR 10.00). These regulations of the Division, however, are adopted independently of and do not depend for their force and effect on the CZM Program or the CZM Regulations.

The CZM Regulations establish the CZM policies, which are part of the CZM Program, as state environmental policy, which the Division recognizes and shall carry out in accordance with the M.G.L. c. 21A, s. 2. The interpretation and application of these Water Quality Certification regulations insofar as they apply to projects in the coastal zone shall be consistent with the policies and Policy Appendix of the CZM Program to the maximum extent permissible by law. The policies listed below, which are further clarified in the CZM Regulations, incorporate the general criteria of the CZM Regulations for determinations made by the Division, but the provisions of the more specific regulations contained in these regulations shall govern. Should the Secretary find through the conflict resolution procedures of M.G.L. c. 21A and/or 301 CMR 10.06(20) through (31) that the Water Quality Certification conflicts with CZM policies, the findings of the Secretary shall apply.

2. In order to enhance the quality and value of water resources, to establish a program for prevention, control and abatement of water pollution and to regulate the discharge of pollutants into the waters of the Commonwealth, the environmental policy of the Division shall be, but need not be limited to:

a. Protecting ecologically significant resource areas (salt marshes, shellfish beds, dunes, beaches, barrier beaches, and salt ponds) for their contributions to marine productivity and value as natural habitats and storm buffers, so far as they relate to water quality impacts;

b. Protecting complexes of marine resource areas of unique productivity [Areas for Preservation or Restoration (APRs) and Areas of Critical Environmental Concern (ACECs)] and ensuring that activities in or impacting such complexes are designed and carried out to minimize adverse effects on marine productivity, habitat values, water quality and storm buffering values of the entire complex:

c. Supporting attainment of the national water quality goals for all waters of the coastal zone through coordination with existing water quality planning and management activities and ensuring that all activities conditioned by the Division are consistent with federal and state effluent limitations and water quality standards; and

d. Ensuring that dredging and disposal of dredged material

minimize adverse effects on water quality, physical processes, marine productivity and public health.

(e) Relationship to the Massachusetts Environmental Policy Act (MEPA), M.G.L. c. 30, ss. 61 - 62H. These regulations are intended to coordinate water quality certifications with the review procedures of EOE agencies and the public under MEPA. All projects which are not categorically excluded under regulations adopted under MEPA will follow the procedure detailed in 314 CMR 9.02(2).

While these regulations address certain obligations of the applicant pursuant to MEPA, they in no way relieve the applicant of his responsibility to ascertain and comply with such obligations himself under any applicable MEPA regulations.

- (3) Definitions - as used in these regulations, the following words have the following meanings, unless the context clearly indicates otherwise:

Applicant - A person conducting any activity or the construction of any project which involves dredging, dredged material disposal or filling in any waters of the Commonwealth.

Application and Application Form - The application appended to these regulations.

Certification - The document issued by the Division signifying compliance or noncompliance with these regulations.

Coastal Zone - The area defined by 301 CMR 10.03 of the CZM Regulations.

Department - The Department of Environmental Quality Engineering.

Director - The Director of the Massachusetts Division of Water Pollution Control, whose authority, powers and duties are established in M.G.L. c. 21, ss. 26 - 53.

Division - The Massachusetts Division of Water Pollution Control, established pursuant to M.G.L. c. 21, s. 26.

Environmental Impact Report of EIR - The report described in MEPA and MEPA regulations.

Environmental Notification Form or ENF - The Form set out in Appendix A to the MEPA regulations.

Environmental Monitor - The publication described in 301 CMR 10.14(1).

High Energy Sites - Locations in the open ocean where the average movement of the water in contact with the bottom exceeds 0.3 feet per second; suitable only for unconsolidated material.

Low Energy Sites - Locations in the open ocean where the average movement of the water in contact with the bottom is less than 0.06 feet per second.

Massachusetts Act - The Massachusetts Clean Waters Act, M.G.L. c. 21, ss. 26 - 53.

MEPA - The Massachusetts Environmental Policy Act, M.G.L. c. 30, ss. 61 - 62H, as amended.

MEPA regulations - The regulations adopted by the Secretary to implement MEPA. (301 CMR).

Permit or Section 43 permit - A permit issued by the Director pursuant to M.G.L. c. 21, s. 43.

Person - Any agency or political subdivision of the Commonwealth or the Federal government, public or private corporation or authority, individual, partnership or association, or other entity, including any officer of a public or private agency or organization.

Project - The subject of an application filed pursuant to these regulations, including the methods of dredging or filling, transporting and disposing of dredged material.

Sandy Sites - Locations in the open ocean where the composition bottom sample contains no more than 20% (by weight) of particles less than 0.064 mm in diameter.

Silty Sites - Locations in the open ocean where the composition of a bottom sample contains more than 21% (by weight) of particles less than 0.064 mm in diameter.

Secretary - The Secretary of the Executive Office of Environmental Affairs.

Standard Application Form - Part I of the application appended as Appendix A to these regulations.

Supplemental Information Form - Part II of the application in Appendix B of these regulations.

Waters of the Commonwealth - All waters within the jurisdiction of the Commonwealth, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries and coastal waters and ground-waters.

(4) Sampling Methods - For the purpose of collecting, preserving and analyzing samples in connection with these regulations, the following methods shall be used:

(a) U.S. Environmental Protection Agency, "Methods for Chemical Analysis of Water and Wastes, "EPA-625/6/74-003, July 1974, National Environmental Research Center, Analytical Quality Control Laboratory, Cincinnati, Ohio. (Available from the Office of Technology Transfer, Washington, D.C. 20460).

(b) American Public Health Association, Standard Methods for the Examination of Water and Wastewater. 14th Ed., American Water Works Association, Water Pollution Control Federation, APHA, New York, 1971.

(c) American Society for Testing Materials, 1974 Annual of ASTM Standards, Part 31, Water. 1974. Philadelphia.

Where a method is not given in these publications or a method given in these publications is not appropriate, any other equivalent method approved by the Director shall be used.

9.02: Submission of an Application

(1) Application Form - The application appended to these regulations is hereby adopted and incorporated as part of these regulations. The application consists of two parts: a "Standard Application Form"; and a "Supplemental Information Form". Copies of the application are available from the Director. Applicants need to complete only the Standard Application Form until informed that additional information is required.

(2) Categorically Excluded Projects - For projects categorically excluded under the MEPA regulations, applicants shall file a completed Standard Application Form with the Division or with the Division of Waterways or the Wetlands Division, as appropriate. Upon receipt or referral of the application the Director will review it to determine its completeness and the need for the Supplemental Information Form. If the Director deems the application incomplete, he shall so notify the applicant within 30 days of his receipt of the application. The application will not be processed by the Division until the inadequacies identified by the Director have been corrected by the applicant unless the applicant fails to correct the inadequacies identified by the Director within 30 days of receiving notice of such inadequacies or requests that the application be processed as submitted. In such case the Division will proceed to process the application. The insufficiency of the information in the application may result in, and form the basis for, a denial of the certification.

(3) Projects not Categorically Excluded

(a) For all projects which are not categorically excluded under the MEPA regulations the applicant shall submit to the MEPA Unit a completed Standard Application Form with the ENF and shall simultaneously distribute copies of the ENF and the Standard Application Form to all EOE agencies on the dredging distribution list maintained and available from the MEPA unit.

(b) As provided by the MEPA Regulations, within 20 days of the publication of the notice of the Secretary's receipt of the ENF, EOE agencies and the public may inform the Secretary of their opinion regarding the need for an EIR. If more information is required in order to address issues raised regarding the project (whether under the scope of review of the Division or not), a scoping session may be held by the MEPA Unit to determine the

issues which need to be addressed. Based upon the scoping session, the Supplemental Information Form may be required. It is intended that questions regarding disposal alternatives, dredging techniques, and the appropriateness of the disposal classifications will be evaluated by the Division in concert with the MEPA process.

(c) The Division shall act on a water quality certification application within 90 days of the publication of notice of the availability of the final EIR, within 90 days of publication of notice in the Environmental Monitor that an EIR is not required, or within 90 days of the completion of the full application, whichever is latest.

9.03 Criteria for the Evaluation of Applications

(1) General - The criteria contained in this part are adopted as interim guidance for the evaluation of dredging, dredge material disposal and filling projects in the waters of the Commonwealth. In the opinion of the Division, these criteria represent the best information currently available for evaluation of such projects in Massachusetts waters. As additional information becomes available, these criteria will be modified to reflect the latest and best data and evaluation procedures.

The criteria contained in the following sections form the basis for the evaluation of dredging projects and shall be presumed to be appropriate unless other information is presented for a particular project. In the case of projects subject to the MEPA process, additional information may be generated relative to the expected impacts from the dredge spoil, the options available for disposal techniques, or alternative sites.

(2) Classification of Dredge or Fill Material - On the basis of the application forms, the MEPA process, and any other information presented to the Division, the Division will classify the dredge or fill material into one of three categories and will impose such conditions on the project as may be necessary. The categories will generally be determined by the chemical constituents (see Table 1) of the material but the material will also be subdivided into one of three physical types (Table 2).

(3)

TABLE 1
Classification of Dredge or Fill Material
by Chemical Constituents
All units are in parts per million

	<u>Category I</u>	<u>Category II</u>	<u>Category III</u>
Arsenic (As)	< 10	10-20	> 20
Cadmium (Cd)	< 5	5-10	> 10
Chromium (Cr)	<100	100-300	>300
Copper (Cu)	<200	200-400	>400
Lead (Pb)	<100	100-200	>200
Mercury (Hg)	< 0.5	0.5-1.5	> 1.5
Nickel (Ni)	< 50	50-100	>100
Polychlorinated Biphenyls (PCB)	< 0.5	0.5-1.0	>1.0
Vanadium (V)	< 75	75-125	>125
Zinc (Zn)	<200	200-400	>400

Category One materials are those which contain no chemicals listed in Table 1 in concentrations exceeding those listed in the first column.

Category Two materials are those which contain any one or more of the chemicals listed in Table 1 in the concentration range shown in the second column.

Category Three materials are those materials which contain any chemical listed in Table 1 in a concentration greater than shown in the third column.

Other important man-induced chemicals or compounds not included in Table 1 which are known or suspected to be in the sediments at the dredge sight will of course be given weight in the classification of the material and the choice of dredging and disposal methods. When the Division has reason to suspect the presence of any other toxins due to a nearby discharge, additional testing for that element may be required.

(4)

TABLE 2
Classification of Dredge or Fill Material
by Physical Characteristics

	<u>Type A</u>	<u>Type B</u>	<u>Type C</u>
Percent silt-clay	< 60	60-90	> 90
Percent water	< 40	40-60	> 60
Percent volatile solids (NED methods)	< 5	5-10	> 10
Percent oil and greases (hexane extract)	<0.5	0.5-1.0	>1.0

Typed A materials are those materials which contain no substances listed in Table 2 exceeding the amounts indicated in the first column.

Type B materials are those materials which contain any one or more of the substances listed in Table 2 in the concentration range shown in the second column.

Type C materials are those materials which contain any substance listed in Table 2 in a concentration greater than shown in the third column.

When the Division has reason to suspect that biological contaminants are present (for example, because of the physical parameters) additional testing may be required.

(5) Dredging, Filling and Disposal Techniques - Table 3 identifies the normally approvable techniques for dredging or filling, the normally approvable methods of placing or disposal of the material and the normally approvable types of disposal sites. The table should be used in concert with Section 25-26 of the Waterways Regulations.

TABLE 3

Normally Approvable Dredging, Handling and Disposal Options

CHEMICAL TYPE (TABLE 1)	<u>Category One</u>			<u>Category Two</u>			<u>Category Three</u>		
PHYSICAL TYPE (TABLE 2)	<u>A</u>	<u>B</u>	<u>C</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>A</u>	<u>B</u>	<u>C</u>
<u>Dredging Methods</u>									
Hydraulic	X	X	X	X	X	X	X	X	X
Mechanical	X	X	X	X	X	X	X	X	X
<u>Disposal Methods</u>									
Hydraulic: Sidecast	X	X	0	0	0	0	0	0	0
Hydraulic: Pipeline	X	X	X	X	X	X	X	X	X
Mechanical: Sidecast	X	X	0	0	0	0	0	0	0
Mechanical: Barge	X	X	X	X	X	X	X	X	X
<u>Placement</u>									
Land or in-harbor disposal with bulk-heading:	X	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Open ocean disposal at high energy, sandy sites	X	0	0	0	0	0	0	0	0
Open ocean disposal at low energy, silty sites	0	X	(b)	0	(b)	(b)	(b)	(b)	(b)
Unconfined in-harbor	X	0	0	0	0	0	0	0	0

TABLE 3 (CONTINUED)

	<u>Category One</u>			<u>Category Two</u>			<u>Category Three</u>		
	<u>A</u>	<u>B</u>	<u>C</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>A</u>	<u>B</u>	<u>C</u>
<u>Placement (continued)</u>									
Beach Replenishment	X	0	0	0	0	0	0	0	0
<u>Other Conditions</u>									
Timing and Placement to Avoid Fisheries Impacts (spawning and running periods and areas)	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(c)

Legend: X = Normally approvable
 0 = Not normally approvable
 (a) = Normally approval but control
 of effluent will be required
 (b) = Approvable only after bioassay, performed in
 accordance with established EPA procedures,
 indicates no significant biological impact.
 A statistically comparable project which has
 successfully passed the bioassay test may be
 substituted. If a significant biological
 impact is found, this material is unsuitable
 for open water disposal.
 (c) = Required in all cases.

9.04: Water Quality Certification

(1) Water Quality Certification - The Division will certify to the appropriate federal or state agency whether or not the proposed project or the project as subsequently modified, together with any conditions thereto, will ensure the maintenance or attainment of the Massachusetts Water Quality Standards in the affected waters of the Commonwealth and will minimize the impact of the project on the environment.

Copies of the certification will be forwarded to the applicant and such other persons and agencies requesting a copy.

The certification as issued will contain:

- the name and address of the applicant;
- the federal license or permit application identification number, if applicable;
- a statement that there is reasonable assurance that the project or activity will be conducted in a manner in the affected waters of the Commonwealth and will minimize the impact of the project on the environment.

Copies of the certification will be forwarded to the applicant and such other persons and agencies requesting a copy.

The certification as issued will contain:

- the name and address of the applicant;

- the federal license or permit application identification number, if applicable;
- a statement that there is reasonable assurance that the project or activity will be conducted in a manner the project, or compliance with any applicable provisions of Massachusetts law which the Director is required or authorized to address; and
- a statement that this certification does not relieve the applicant of the duty to comply with any other statutes or regulations.

(2) Notice and Hearing - Public notice of the pendency of the Water Quality Certification shall be provided as part of the Section 6(5) notice of the regulations for the Administration of Waterways Licenses. The Division will participate in any hearings resulting from the Waterways process if the water quality certification is at issue. All issues related to the water quality certification must be raised at such hearing.

9.05: Miscellaneous Provisions

(1) Enforcement - Failure to comply with these regulations shall be enforced as provided in M.G.L. c. 21, s. 42.

(2) Severability - Should any provision of these regulations be held invalid, the remainder shall not be affected thereby.

(3) Other Regulations - Nothing in these regulations shall be construed as nullifying any regulation of another agency of the Commonwealth limiting the use of the waters and/or adjacent lands for other purposes.

(4) Waiver - The Division may waive certain testing requirements in Class A waters if, on the basis of the history of the area and/or samples of shellfish or sediment taken by the Division, the Department or the Division of Marine Fisheries within the last 3 years, the area to be dredged is known to fall into Category One.

(5) Emergency Action - In the rare situation where immediate action by an agency or person is essential to avoid or eliminate an immediate threat to the public health or safety, or a serious and immediate threat to natural resources, a project may commence without a certification provided that the agency or person must have obtained the prior approval of the Director. In all cases an application will be required within 10 days of the commencement of the project and the applicant shall commence full compliance with the provisions of these regulations.

An emergency action taken under this section prior to the submission of an application shall be calculated to minimize damage to the environment without compromising the end sought to be attained in the emergency action. Where the reasons for undertaking the emergency action no longer exist, any emergency action taken under this section shall cease until the provisions of these regulations and any other laws and regulations concerning the project have been complied with.

(6) Effective Date - These regulations shall take effect September 15, 1978. Any application submitted to the Division prior to September 15, 1978, shall be considered under the standards and criteria in effect prior to the adoption of these regulations.

